WHAT IS CLAIMED IS:

1. A ZnO film on a substrate, the ZnO film containing a p-type dopant and having a net acceptor concentration of at least about 10^{15} acceptors/cm^3, a resistivity no greater than about 1 ohm-cm, and a Hall Mobility of between about 0.1 and about 50 cm^2/Vs.

2. The film as set forth in claim 1 wherein the net acceptor concentration is between about 10^{18} acceptors/cm^3 and about 10^{21} acceptors/cm^3, the resistivity is between about 1 ohm-cm and about 10^{-4} ohm-cm, and the Hall Mobility is between about 0.1 and about 50 cm^2/Vs.

3. The film as set forth in claim 1 wherein the net acceptor concentration is at least about 10^{16} acceptors/cm^3, the resistivity is between about 1 ohm-cm and about 10^{-4} ohm-cm, and the Hall Mobility is between about 0.1 and about 50 cm^2/Vs.

4. The film as set forth in claim 1 wherein the p-type ZnO film has a thickness of between about 0.5 and about 3 micrometers.

5. The film as set forth in claim 1 wherein the p-type dopant is arsenic.

6. The film as set forth in claim 1 wherein the substrate is GaAs.

7. The film as set forth in claim 1 wherein the substrate is sapphire.

8. The film as set forth in claim 1 wherein the substrate is ZnO.

9. The film as set forth in claim 1 wherein the p-type dopant is arsenic and the substrate is GaAs.

10. The film as set forth in claim 1 wherein the p-type dopant is selected from Group 1, 11, 5, and 15 elements.

11. The film as set forth in claim 1 wherein the film is incorporated into a p-n junction.

12. The film as set forth in claim 1 wherein the film is incorporated into a field effect transistor.

13. The film as set forth in claim 1 wherein the film is incorporated into a light emitting diode.

14. The film as set forth in claim 1 wherein the film is incorporated into a laser diode.

15. The film as set forth in claim 1 wherein the film is incorporated into a photodetector diode.

16. The film as set forth in claim 1 wherein the film is incorporated into a transducer diode.

17. The film as set forth in claim 1 wherein the film is incorporated into a device as a substrate material for lattice matching to materials in the device.

18. The film as set forth in claim 2 wherein the p-type ZnO film has a thickness of between about 0.5 and about 3 micrometers.

19. The film as set forth in claim 2 wherein the p-type dopant is arsenic.

20. The film as set forth in claim 2 wherein the substrate is GaAs.

21. The film as set forth in claim 2 wherein the p-type dopant is arsenic and the substrate is GaAs.

22. The film as set forth in claim 2 wherein the p-type dopant is selected from Group 1, 11, 5, and 15 elements.

23. The film as set forth in claim 2 wherein the film is incorporated into a p-n junction.

24. The film as set forth in claim 2 wherein the film is incorporated into a field effect transistor.

25. The film as set forth in claim 2 wherein the film is incorporated into a light emitting diode.

26. The film as set forth in claim 2 wherein the film is incorporated into a laser diode.

27. The film as set forth in claim 2 wherein the film is incorporated into a photodetector diode.

28. The film as set forth in claim 2 wherein the film is incorporated into a transducer diode.

29. The film as set forth in claim 2 wherein the film is incorporated into a device as a substrate material for lattice matching to materials in the device.

30. A process for growing a p-type ZnO film containing arsenic on a GaAs substrate in a pulsed laser deposition chamber, the process comprising:

cleaning the GaAs substrate;

adjusting the temperature of the substrate in the pulsed laser deposition chamber to between about 300°C to about 450°C;

pre-ablating a polycrystalline ZnO crystal;

directing an excimer pulsed laser beam onto the polycrystalline ZnO crystal to grow a film on the GaAs substrate;

increasing the temperature of the substrate in the pulsed laser deposition chamber to between about 450°C and about 600°C; and

annealing the ZnO coated GaAs substrate to diffuse at least about $1x10^{15}$ acceptors/cm^3 from the GaAs into the ZnO film to produce an arsenic doped ZnO film.

31. The process as set forth in claim 30 wherein the ZnO film has a thickness of between about 0.5 and about 3 micrometers.

32. The process as set forth in claim 30 wherein the arsenic doped ZnO film has a net acceptor concentration of between about $1x10^{18}$ acceptors/cm^3 and about $1x10^{21}$ acceptors/cm^3, a resistivity of between about 1 and about $1x10^{-4}$ ohm-cm, and a Hall Mobility of between about 0.1 and about 50 cm^2/Vs.

33. The process as set forth in claim 30 wherein the arsenic doped ZnO film has a net acceptor concentration of at least about $1x10^{16}$ acceptors/cm^3, a resistivity of between about 1 and about $1x10^{-4}$ ohm-cm, and a Hall Mobility of between about 0.1 and about 50 cm^2/Vs.

34. The process as set forth in claim 30 wherein the substrate is cleaned in the pulsed laser deposition chamber using a pulsed excimer laser.

35. The process for growing a p-type ZnO film on a substrate, the process comprising:

cleaning the substrate;

adjusting the temperature in the pulsed laser deposition chamber to between about 200°C and about 1000°C; and

growing a p-type ZnO film on the substrate by directing an excimer pulsed laser beam onto a pressed ZnO powder pellet containing a p-type dopant to grow a p-type

ZnO film containing at least about 10^{15} acceptors/cm^3 on the substrate.

36. The process as set forth in claim 35 wherein the temperature in the pulsed laser deposition chamber is adjusted to between about 300°C and about 450°C.

37. The process as set forth in claim 35 wherein the p-type ZnO film has a thickness of between about 0.5 and about 3 micrometers.

38. The process as set forth in claim 35 wherein the p-type dopant is selected from group 1, 11, 5, and 15 elements.

39. The process as set forth in claim 35 wherein the p-type ZnO film has a net acceptor concentration of between about 10^{18} acceptors/cm^3 and about 10^{21} acceptors/cm^3, a resistivity no greater than about 1 ohm-cm, and a Hall Mobility of between about 0.1 and about 50 cm^2/Vs.

40. The process as set forth in claim 35 wherein the p-type ZnO film has a net acceptor concentration of at least about 10^{16} acceptors/cm^3, a resistivity no greater than about 1 ohm-cm, and a Hall Mobility of between about 0.1 and about 50 cm^2/Vs.

41. The process as set forth in claim 35 wherein the p-type dopant is arsenic.

42. The process as set forth in claim 35 wherein the substrate is cleaned in the pulsed laser deposition chamber using a pulsed excimer laser.

43. A process for preparing a p-n junction having a p-type ZnO film and an n-type film wherein the net acceptor concentration is at least about 10^{15} acceptors/cm^3, the process comprising:

cleaning a substrate;

adjusting the temperature of the substrate in the pulsed laser deposition chamber to between about 200°C to about 1000°C;

growing a p-type ZnO film on the substrate by directing an excimer pulsed laser beam onto a pressed ZnO powder pellet containing a p-type dopant element to grow a p-type ZnO film containing at least about 10^{18} acceptors/cm^3 on the substrate; and

growing an n-type film on top of the p-type ZnO film by directing an excimer pulsed laser beam onto a pressed powder pellet containing an n-type dopant element to grow an n-type film on the p-type ZnO film on the substrate.

44. The process as set forth in claim 43 wherein the n-type film has a thickness of between about 0.5 and about 3 micrometers and the p-type film has a thickness of between about 0.5 and about 3 micrometers.

45. The process as set forth in claim 43 wherein the p-type dopant element is arsenic and the n-type dopant element is aluminum.

46. The process as set forth in claim 43 wherein the p-n junction is a homoepitaxial p-n junction wherein the p-type film consists of arsenic and ZnO and the n-type film consists of an n-type dopant element and ZnO.

47. The process as set forth in claim 43 wherein the p-n junction is a heteroepitaxial p-n junction wherein the p-type film consists of arsenic and ZnO and the n-type film contains an n-type dopant and has an energy band gap different than ZnO.

48. The process as set forth in claim 43 wherein the substrate is cleaned in the pulsed laser deposition chamber using a pulsed excimer laser.

49. The process as set forth in claim 43 wherein the net acceptor concentration is at least about 10^{16} acceptors/cm^3.

50. A process for preparing a p-n junction having a p-type ZnO film and an n-type film wherein the net acceptor concentration is at least about 10^{15} acceptors/cm^3, the process comprising:

cleaning a substrate;

adjusting the temperature in the pulsed laser deposition chamber to between about 200°C to about 1000°C;

growing an n-type film on top of the substrate by directing an excimer pulsed laser beam onto a pressed

powder pellet containing an n-type dopant element to grow an n-type film on the substrate;

growing a p-type ZnO film on the n-type film by directing an excimer pulsed laser beam onto a pressed ZnO powder pellet containing a p-type dopant element to grow a p-type ZnO film containing at least about 10^{18} acceptors/cm^3 on the n-type film.

51. The process as set forth in claim 50 wherein the n-type film has a thickness of between about 0.5 and about 3 micrometers and the p-type film has a thickness of between about 0.5 and about 3 micrometers.

52. The process as set forth in claim 50 wherein the p-type dopant element is arsenic and the n-type dopant element is aluminum.

53. The process as set forth in claim 50 wherein the p-n junction is a homoepitaxial p-n junction wherein the p-type film consists of arsenic and ZnO and the n-type film consists of an n-type dopant element and ZnO.

54. The process as set forth in claim 50 wherein the p-n junction is a heteroepitaxial p-n junction wherein the p-type film consists of arsenic and ZnO and the n-type film contains an n-type dopant and has an energy band gap different than ZnO.

55. The process as set forth in claim 50 wherein the substrate is cleaned in the pulsed laser deposition chamber using a pulsed excimer laser.

56. The process as set forth in claim 50 wherein the net acceptor concentration is at least about 10^{16} acceptors/cm^3.

57. A process for cleaning a substrate in a chamber prior to growing a film on the substrate, the process comprising:

loading the substrate into the chamber and adjusting the temperature in the chamber to between about 400°C and about 500°C;

filling the chamber with hydrogen to create a pressure in the chamber of between about 0.5 and about 3 Torr;

adjusting the distance between a metal shutter in the chamber and the substrate to between about 3 to about 6 centimeters; and

directing an excimer pulsed laser beam having an intensity of between about 20 to about 70 mJ and a repetition of between about 10 to about 30 Hz into the chamber for a period of between about 5 and about 30 minutes to illuminate the metal shutter and clean the substrate.

58. The process as set forth in claim 57 wherein the chamber temperature is about 450°C, the metal shutter is about 4 centimeters from the substrate, and an argon fluoride pulsed excimer laser having an intensity of about 50 mJ and a repetition of about 20 Hz illuminates the shutter for about 20 minutes to clean the substrate.

59. A p-type film on a substrate wherein the film contains a p-type dopant which is an element which is the same as an element which is a constituent of the substrate.

60. The p-type film as set forth in claim 59 wherein the p-type film comprises ZnO, the substrate comprises GaAs, and the element which is the p-type dopant and a constituent of the substrate is arsenic.

61. A process for preparing a p-n junction having a p-type ZnO film and an n-type ZnO film on a p-type doped substrate wherein the net acceptor concentration of the substrate and p-type ZnO film is at least about 10^{15} acceptors/cm^3, the process comprising:

adjusting the temperature of the substrate in a pulsed laser deposition chamber to between about 200 and about 1000°C;

growing a p-type ZnO film on the p-type doped substrate by directing an excimer pulsed laser beam onto a pressed ZnO powder pellet containing a p-type dopant element to grow a p-type ZnO film containing at least about 10^{15} acceptors/cm^3 on the p-type doped substrate; and

growing an n-type film on top of the p-type ZnO film by directing an excimer pulsed laser beam onto a pressed powder pellet containing an n-type dopant element to grow an n-type film on the p-type ZnO film on the p-type substrate.

62. The process as set forth in claim 61 wherein the substrate is cleaned prior to growing the p-type and n-type films.

63. The process as set forth in claim 61 wherein the p-type dopant element of the film is arsenic, the n-type dopant element is aluminum, the substrate is GaAs, and the p-type dopant element of the substrate is zinc.

64. The process as set forth in claim 61 wherein the p-n junction is a homoepitaxial p-n junction wherein the p-type film consists of arsenic and ZnO and the n-type film consists of an n-type dopant element and ZnO.

65. The process as set forth in claim 61 wherein the p-n junction is a heteroepitaxial p-n junction wherein the p-type film consists of arsenic and ZnO and the n-type film contains an n-type dopant and has an energy band gap different than ZnO.

66. The process as set forth in claim 61 wherein the temperature of the substrate in the laser deposition chamber is adjusted to between about 400°C and about 450°C and the p-type ZnO film is grown on the p-type doped substrate by directing an excimer pulsed laser beam onto a pressed ZnO powder pellet.

67. A process for growing a doped ZnO film on a substrate, the process comprising:

adjusting the temperature of the substrate in a pulsed laser deposition chamber to between about 200°C and about 1000°C;

preablating a polycrystalline ZnO crystal target; and

directing the excimer pulsed laser beam onto the polycrystalline ZnO crystal target to grow a film on the GaAs substrate while simultaneously directing a molecular beam containing a dopant onto the growing ZnO film for a time sufficient to incorporate at least about 10^{15} dopant/cm^3.

68. The process as set forth in claim 67 wherein a p-type ZnO film is grown on the substrate using a arsenic molecular beam wherein the p-type dopant is selected from the group consisting of Group 1, Group 11, Group 5, and Group 15 elements.

69. The process as set forth in claim 67 wherein an n-type ZnO film is grown on the substrate using a molecular beam wherein the n-type dopant is selected from the group consisting of aluminum, gallium, and indium.

70. The process as set forth in claim 67 wherein two doped ZnO films are grown on a substrate to form a p-n junction, the first doped ZnO film being p-type and being grown on the substrate and the second ZnO film being n-type and being grown on top of the p-type film.

71. The process as set forth in claim 67 wherein two doped ZnO films are grown on a substrate to form a

p-n junction, the first doped ZnO film being n-type and being grown on the substrate and the second ZnO film being p-type and being grown on top of the n-type film.

72. An oxide film on a substrate, the oxide film containing a p-type dopant and having a net acceptor concentration of at least about 10^{15} acceptors/cm^3, a resistivity no greater than about 1 ohm-cm, and a Hall Mobility of between about 0.1 and about 50 cm^2/Vs.

73. The film as set forth in claim 72 wherein the net acceptor concentration is between about 10^{18} acceptors/cm^3 and about 10^{21} acceptors/cm^3, the resistivity is between about 1 ohm-cm and about 10^{-4} ohm-cm, and the Hall Mobility is between about 0.1 and about 50 cm^2/Vs.

74. The film as set forth in claim 72 wherein the net acceptor concentration is at least about 10^{16} acceptors/cm^3, the resistivity is between about 1 ohm-cm and about 10^{-4} ohm-cm, and the Hall Mobility is between about 0.1 and about 50 cm^2/Vs.

75. The film as set forth in claim 72 wherein the p-type film has a thickness of between about 0.5 and about 3 micrometers.

76. The film as set forth in claim 72 wherein the p-type dopant is arsenic.

77. The film as set forth in claim 72 wherein the film is a zinc oxide film.